Center Innovation Fund: GSFC CIF

A Compact Extreme Ultraviolet Imager (C-EUVI)

Completed Technology Project (2012 - 2014)

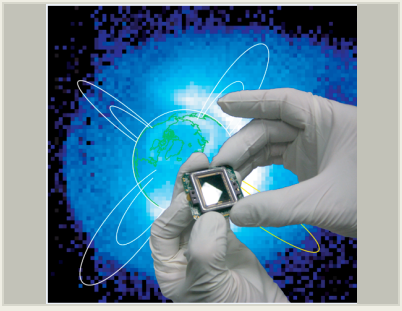
Project Introduction

Just how far can one shrink a solar/heliospheric image??? — Can you shrink it small enough to fit on a cube-sat? What can we image — successfully — from a cube-sat? And given the technical challenges of maintaining optical sensitivity, thermal control and radiation hardening… perhaps the more vexing question is… Can one design an imager — one adapted and miniaturized specifically for cube–sat implementation — that is applicable to multiple scientific objectives? We "answer" these questions with a resounding — Yes!!! We believe that the Heliophysics Science Division/Code 670 is in the unique position to develop a compact, cube–sat-based EUV imager — based upon a commercially–available prototype low-light level camera — capable of either making observations of the Sun and solar corona, or observations of Earth's plasmasphere. Identical emissions — yet emanating from vastly different plasma environments and, therefore, each carrying its own unique set of information regarding the state of the plasma environment from whence the emissions came. Despite the apparent physical disparities of these environs, using the same basic EUV imager — but employing a slightly different front-end lens/telescopic system — one could, in principle, be in a position to image either of two vastly different plasma environments as requirements dictated. With the successful development of such an imager, GSFC would be uniquely well positioned — strategically — to take advantage of the growing number of cube–/μ–/nano–satellite flight opportunities.

We propose to evaluate the Intevac Photonics NightVista® M711 Low Light Level Camera as the baseline detector of a new Compact EUV imager (C–EUVI). To accomplish this task, we will procure a prototype model M711 camera — w/o image intensification — design and implement an appropriate prototype comm-interface, place the unit under vacuum and then test/validate the efficiency/sensitivity of the camera to a range of EUV wavelengths. The effort will also test/validate the uniformity of — i.e., "flat-field" — the detector. The resulting data set will then used to baseline the viability of implementing this commercially available camera/detector for solar/heliospheric imaging applications. Development of a compact, cube–sat-based EUV imager exploits the advantages of using a [prototype,] commercially available, back-illuminated CMOS anode, low-light level camera. Numerous advantages to exploiting this approach exist, including: Minimal technical risk since the bulk of the camera development is complete; Cube–sat compatible dimensions and power requirements; Use of a CMOS detector is advantageous since it: Avoids the need for active thermal control required by a CCD detector; Provides stable detection in radiation environments; and finally Has a predicted QE > 40% from 2–600Å (soft X-ray to EUV wavelengths).

Anticipated Benefits

Development of ***C-EUVI*** fosters the Heliophysics *Line-of-Business* goal to



C-EUVI In-Hand

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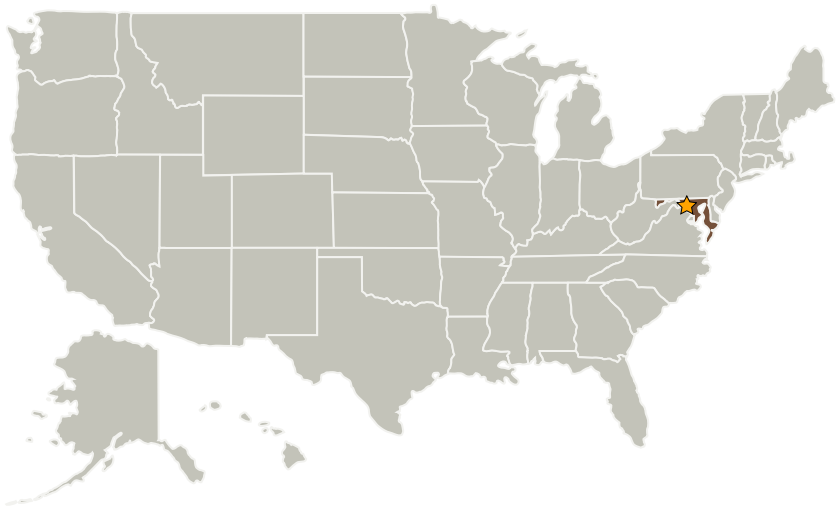
develop miniaturized and resource-prudent instrumentation for Heliophysics research missions. The development of a miniaturized/compact, cube-sat ready EUV imager would place GSFC in a unique position to compete for plasma instrumentation on future *μ-/nano*-satellite, constellation or other Heliospheric missions — such as the *Solar Energetic Particle Acceleration and Transport* (STP #6 SEPAT) or *Heliospheric Magnetics* (LWS #9 HMag).

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Primary U.S. Work Locations
Maryland

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Innovation Fund: GSFC CIF

Project Management

Program Director:

Michael R Lapointe

Program Manager:

Peter M Hughes

Project Manager:

Nikolaos Paschalidis

Principal Investigator:

Mark L Adrian

Co-Investigators:

Douglas M Rabin
Adrian N Daw
James P Haas

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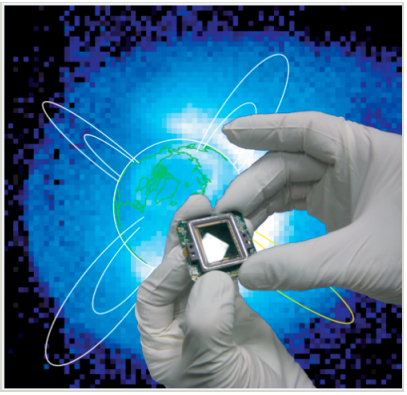
Images



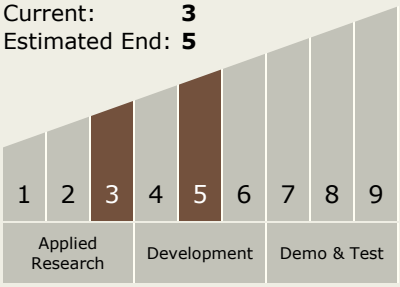
A Compact Extreme Ultraviolet Imager (C-EUVI) Project
C-EUVI In-Hand
(https://techport.nasa.gov/image/4103)

Project Website:

http://sciences.gsfc.nasa.gov/sed/

Technology Maturity (TRL)

Start: **3**
Current: **3**
Estimated End: **5**



Technology Areas

Primary:

- TX08 Sensors and Instruments
  - TX08.1 Remote Sensing Instruments/Sensors
    - TX08.1.3 Optical Components